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TITLE OF THE INVENTION

SHOE PRESS

INVENTOR

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SHOE PRESS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under 35 U.S.C. § 119 of German Patent Application Nos. 100 54 674.9 filed November 3, 2000 and 201 00 509.3 filed January 12, 2001, the disclosures of which are expressly incorporated by reference herein in their entireties.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a shoe press for processing a fibrous material web, in particular a paper or cardboard web, having two shoe press units between which an essentially level felted press nip is formed in the web travel direction and having one circulating flexible continuous sealing belt each guided over the press shoe in the region of the press nip. The invention additionally relates to a press section having such a shoe press.

2. Discussion of Background Information

In each of the previously known double-felted presses known as TandemNipco-Flex or the UltraNipcoFlex, only one roll is driven. These known presses have the disadvantage, among other things, that relatively strong lateral and/or shearing forces occur in the press nip in the web travel direction. These forces are stronger the longer the press nip is, and stronger when the felts change their dimensions due to the wear in the press nip.

In the case of special paper types and depending on different drive parameters, the sheet structure can be affected negatively. The purpose of Figure 1 is to explain the connection of the nip stress and a one-sided drive of the shoe press.

For this purpose, Figure 1 shows a conventional double-felted shoe press, driven on one side, in a schematic partial representation having a shoe press roll 12

provided with a concave press shoe 10 and a mating roll 14. The flexible press jacket of the shoe press roll 12 is marked "16." An upper felt 20 and a lower felt 22 are guided through the press nip 18. The paper web is positioned between these two felts 20 and 22.

The two felts 20 and 22 enter into the press nip 18 with the thickness S1 and/or S2. Together with the rising pressure in the press nip 18 (compare the pressure progression indicated in the web travel direction L in the upper part of Figure 1)k, the corresponding felt thickness S1 and/or S2 and the corresponding speeds V1 and/or V2 of the neutral fibers 24 in the corresponding felt 20 and 22 automatically reduce (compare the speed progression indicated in the web travel direction L in the lower part of Figure 1), subsequent to being pressed onto a smaller circumferential radius R' by the felt compression and being compressed by the sandwich 26 formed by the felts and the paper web and acting like a spring. Lateral forces automatically occur in the web travel or machine operating direction L, which are additionally overlapped by a frictional force developing on the stationary press shoe 10. Although it is necessary for the driving force for this conventionally double-felted shoe press with a concave press shoe to be very high, it is only driven on one side.

Therefore, in such known shoe presses, considerable lateral forces develop between the separate layers mating roll/lower felt, lower felt/paper, paper/upper felt, upper felt/press jacket, and press jacket/shoe. The strong lateral force and fulling work occurring in the entire sandwich package is particularly caused by the asymmetrical shape change and the different settling characteristics of the layers. The slippage occurring under high pressure between the felts in the web travel direction has negative effects on the sheet structure. Additionally, a paper worn and compressed in the web travel direction requires a higher stress in the subsequent sections, such as the drying section.

A shoe press of the type mentioned at the outset, with an at least essentially level press nip, is known from DE-A-196 38 689.

SUMMARY OF THE INVENTION

The present invention provides an improved shoe press and an improved press section of the type mentioned at the outset in which the above-mentioned disadvantages are avoided and in which a technologically optimal product quality is ensured.

The shoe press according to the invention provides that, on both sides of the material web, a driven continuous press belt is additionally guided together with the material web. The two press belts are each preferably formed by a dewatering belt. The press nip is preferably double-felted, with both felts guided horizontally between the two additional press belts together with the fibrous material web arranged therebetween. Preferably, at least one of the two shoe press units is formed by a shoe press roll and the respective sealing belt by the jacket of the shoe press roll.

In accordance with an exemplary embodiment of the invention, the sandwich to be pressed, which includes the fibrous material web and the felt or felts, can now be guided through the press by the additionally provided press belts, with a straight guidance now being possible over an extended distance particularly before and after the press nip. Accordingly, a pressing practically free of lateral forces results in the extended press nip of the shoe press. A targeted pressing in the z-direction results, being similar to roll presses driven on both sides. Independently of the respective length of the press nip, lateral forces in the machine direction are avoided on the fibrous material web, the felts, and the press jackets. Optimally, a dewatering and web surface on the same side, a high volume, and a good tenacity are ensured. A separation of functions results with regard to the sealing of the shoe press units, and with regard to the dewatering of the nip. Therefore, optimal design possibilities for

the press belts and/or dewatering belts result with respect to the respective requirements independently of the sealing function. For example, a smooth, notch-free sealing belt of a respective shoe press unit is less susceptible to tears on the surface and can therefore be thinner and correspondingly more flexible. A separately guided press belt and/or dewatering belt can be designed more optimally in correspondingly larger deflection radii with respect to the corresponding requirements (e.g., press drive and open press surface). For example, harder grooves and a more stable tensile web is possible. In particular, an even hardness of the press surface is possible (same-sided felt markings). In the sealing belts and/or sealing jackets, the compression and sagging inversion stress is correspondingly smaller in smooth and/or level shoes. In any case, it is ensured by the sealing belts that leaking oil does not directly contact the felts and the fibrous web. Overall, a press concept results that requires fewer spare rolls.

In a useful practical embodiment of a shoe press according to the invention, the press plane through the press nip is inclined with respect to the vertical. Here, the press plane may be inclined particularly by an angle in the range of approximately 10 to approximately 45° with reference to the vertical.

Preferably, at least one of the two press belts is provided with an open press surface. This surface may, in particular, be blind bored and/or grooved. However, it is also possible to form at least one of the two press belts as a wire web.

If one or both press belts are embodied in a water permeable fashion, the corresponding sealing belts, i.e., wrapped thereby, should be provided with an open surface, i.e., be embodied in a grooved and/or blind bored fashion, for example. This considerably increases the dewatering capacity of the arrangement.

In a preferred practical embodiment, at least one of the two press belts is guided around a deflection roll subsequent to the press nip, in the region of which roll

a groove is provided in order to collect the water thrown off the press belt. A doctor or a scraper can be assigned to the respective deflection roll. It is also advantageous for the respective deflection roll to be driven. In general, the respective press belt can be guided around at least one other driven deflection roll as well.

In order to keep potential felt markings on the same side, the press surfaces of the two press belts can be provided with the same hardness.

It is also advantageous for at least one of the two sealing belts of the two shoe press units to be provided with a continuous smooth surface. A smooth, notch-free sealing belt for sealing the shoe press unit and/or the shoe press roll is less susceptible to tears on its surface and, therefore, may be thinner and correspondingly more flexible as well.

It is practical for felts with few markings to be guided through the double-felted press nip, causing a symmetrical dewatering.

Outside of the press nip, the press belts are preferably guided separately from the sealing belts. Therefore, larger deflection radii are possible for the press belts, which allows a better optimization with regard to the respective requirements (press drive, open press surface). Therefore, these press belts may be provided with harder grooves, for example, or with a more stable tensile web.

With regard to the press section, the press section in accordance with the features of the instant invention includes the shoe press. Here, this shoe press is preferably the only press in the press section.

Advantageously, the two felts of the double-felted shoe press are already joined before the press nip and subsequently guided to the press nip together with the fibrous web positioned therebetween. Advantageously, the fibrous material web is also guided together with the two felts out of the press nip for a certain distance. Thus, the sandwich of the fibrous material web and the two felts to be pressed can be

guided straight through the press, with this sandwich being guided in a straight manner for a certain distance, in particular prior to and subsequent to the press nip.

Subsequent to the press nip, the fibrous material web may be guided together with one of the two felts around a suctioned guiding roll, in particular in its region being accepted by a drying wire, for example.

The present invention is directed to a shoe press for processing a fibrous material web that includes two shoe press units arranged to form an essentially level press nip elongated in a web travel direction. Each of the two shoe press units include a circulating flexible, continuous sealing belt and a press shoe, such that the circulating flexible, continuous sealing belt is arranged to be guided over the press shoe in a region of the press nip. At least two driven continuous press belts are arranged such that at least one of the at least two driven continuous press belts are positioned on each side of the fibrous material web to guide the fibrous material web through the press nip.

According to a feature of the invention, the fibrous material web can include one of a paper and a cardboard web.

In accordance with another feature of the instant invention, each of the at least two press belts may include a dewatering belt.

Further, at least two felts can be arranged on opposite sides of the fibrous material web, whereby the press nip forms a double-felted press nip. The at least two felts can arranged between the press belts, such that the at least two felts are guided substantially horizontally through the press nip together with the fibrous material web.

At least one of the two shoe press units may include a shoe press roll and the sealing belt can include a jacket of the shoe press roll.

According to still another feature of the present invention, a press plane through the press nip can be inclined in relation to a vertical reference. The press

plane may be inclined in relation to the vertical reference by an angle (α) in the region of approximately 10° to approximately 45°.

At least one of the at least two press belts can include an open press surface. A press surface of the at least one press belt may be at least one of blind bored and grooved.

Moreover, at least one of the at least two press belts can include a water permeable wire web. At least one of the at least two sealing belts may include an open press surface that is at least one of blind bored and grooved. The at least one water permeable wire web press belt and the at least one open press surface sealing belt can be arranged in a same press shoe unit.

Still further, at least one deflection roll and a collector can be positioned in a region of the at least one deflection roll. Subsequent to the press nip, at least one of the at least two press belts may be guided around the at least one deflection roll, whereby water thrown off the press belt as it is guided around the at least one deflection roll is collected in the collector. A scraper can be allocated to the at least one deflection roll. The at least one deflection roll may be driven. At least one additional driven deflection roll may be provided around which the at least one press belt can be guided. The at least one deflection roll can be structured and arranged as a belt travel control roll.

In accordance with a further feature of the instant invention, press surfaces of the at least two press belts can have a same hardness.

According to a still further feature of the present invention, at least one of the at least two sealing belts can include a continuous, smooth surface.

Moreover, felts with few markings can be guided through the press nip, and the felts may be arranged to cause symmetrical dewatering.

Outside of the press nip, the at least two press belts can be guided separately

from the at least two sealing belts.

Prior to the press nip, at least one of the at least two press belts can be guided around a deflection roll structured and arranged as a belt travel control roll.

The present invention is directed to a press section of a machine for producing a fibrous material web. The press section includes a shoe press including two shoe press units arranged to form an essentially level press nip elongated in a web travel direction. Each of the two shoe press units include a circulating flexible, continuous sealing belt and a press shoe, such that the circulating flexible, continuous sealing belt is arranged to be guided over the press shoe in a region of the press nip. Further, each of the two shoe press units include at least one driven continuous press belt, such that at least one driven continuous press belt is positioned on each side of the fibrous material web to guide the fibrous material web through the press nip.

According to a feature of the present invention, the shoe press can be the only press.

Further, at least two felts can be arranged on opposite sides of the fibrous material web, whereby the press nip forms a double-felted press nip. The at least two felts can be arranged between the press belts, such that the at least two felts are guided substantially horizontally through the press nip together with the fibrous material web.

In accordance with another feature of the instant invention, the fibrous material web can be accepted by one of the at least two felts from a wire belt. Further, a suctioned guidance roll can be located in a region of a transfer position, and at least one of the at least two felts may be guided around the suctioned guidance roll. The fibrous material web may be accepted from the wire belt by an upper felt. Still further, the at least two felts can be brought together before the press nip and can be subsequently guided to the press nip while sandwiching the fibrous material web. Moreover, a suctioned guidance roll may be arranged downstream, relative to a web

run direction, from the press nip, such that the fibrous material web can be guided out of the press nip together with the at least two felts and may be subsequently guided together with one of the at least two felts around the suctioned guidance roll, which is located in a region in which the fibrous material web is accepted by another section of the machine. A drying wire can be guided in the region of the suctioned guidance roll to accept the fibrous material web from the one felt. Further, the one felt can include a lower felt, such that the fibrous material web may be accepted from the lower felt by the drying wire. Further still, another guidance roll may be arranged to guide the one felt, and the fibrous material web may be accepted by the drying wire in a region between the suctioned guidance roll and the another guidance roll. The drying wire can be guided around a suctioned guidance roll in the region of acceptance. The at least two press belts can be arranged to be separated immediately after the press nip from the at least two felts which sandwich the fibrous material web.

The present invention is directed to a shoe press for processing a fibrous material web that includes first and second shoe press units arranged to form an essentially level press nip elongated in a web travel direction. The first shoe press unit includes a first circulating flexible, continuous sealing belt and a first press shoe, such that the first circulating flexible, continuous sealing belt is arranged to be guided over the first press shoe in a region of the press nip, and the second shoe press unit includes a second circulating flexible, continuous sealing belt and a second press shoe, such that the second circulating flexible, continuous sealing belt is arranged to be guided over the second press shoe in a region of the press nip. First and second continuous press belts are arranged such that the first continuous press belt is positioned between the first press shoe and the fibrous material web, and the second continuous press belt is positioned between the second press shoe and the fibrous material web, and first and second press belt driving devices are arranged to drive the

first and the second press belts, respectively.

According to a feature of the invention, first and second felts can be arranged to sandwich the fibrous material web. The first and second felts may be arranged between the first and second press belts.

In accordance with yet another feature of the present invention, a pressing plane of the press nip can be obliquely oriented in relation to a vertical reference. The pressing plane may be obliquely oriented at an angle of between about 10° and about 45° from the vertical reference.

Other exemplary embodiments and advantages of the present invention may be ascertained by reviewing the present disclosure and the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is further described in the detailed description which follows, in reference to the noted plurality of drawings by way of non-limiting examples of exemplary embodiments of the present invention, in which like reference numerals represent similar parts throughout the several views of the drawings, and wherein:

Figure 1 schematically illustrates a partial representation of a conventional double-felted shoe press, driven on one side, having a concave press shoe;

Figure 2 schematically illustrates an exemplary embodiment of a shoe press according to the instant invention which includes a shoe press according to the instant invention; and

Figure 3 schematically illustrates an enlarged schematic representation of a nip region of the exemplary embodiment of a shoe press depicted in Figure 2 with a pressure progression resulting along the press nip.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

The particulars shown herein are by way of example and for purposes of

illustrative discussion of the embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the present invention. In this regard, no attempt is made to show structural details of the present invention in more detail than is necessary for the fundamental understanding of the present invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the present invention may be embodied in practice.

Figure 2 shows a schematic representation of an exemplary embodiment of a press section 28 according to the invention of a machine for producing a fibrous material web 30 which may, in particular, be a paper web or a cardboard web. The press section 28 is provided with a single press, i.e., a shoe press 32 according to the invention. Figure 3 shows an enlarged schematic representation of the nip region of the embodiment of the shoe press according to the invention shown in Figure 2. In the upper part of this Figure 3, the resulting pressing progression is indicated along the press nip of the shoe press 32.

According to Figures 2 and 3, the shoe press 32 comprises two shoe press units 34 and 36 with a press nip 38 formed therebetween that is at least essentially level and elongated in the web travel direction L. This press nip 38 is double-felted in the present case.

The two shoe press units 34 and 36 are each provided with a circulating flexible continuous sealing belt 44 and 46, guided over a press shoe 40 and 42 respectively, in the region of the press nip 38. Additionally, a driven continuous press belt 48, 50 respectively, is guided through the double-felted press nip 38 on both sides of the fibrous material web 30 each. The two press belts 48 and 50 are each formed by a dewatering belt.

As is discernible from Figures 2 and 3, both an upper felt 52 and a lower felt 54 are provided. Guided horizontally through the press nip 38 between the two additional press belts 58 and 50, the two felts 52 and 54 are provided together with the fibrous material web 30 positioned therebetween.

In the present exemplary embodiment, the two shoe press units 34 and 36 are each formed by a shoe press roll, and the sealing belts 44 and 46 are each correspondingly formed by the jacket of the respective shoe press roll.

In order to form the at least essentially even press nip 38, the two press shoes 40 and 42 are each provided with an at least essentially level support surface over which the respective sealing belt 44 and 46 is guided.

In the present exemplary embodiment, the press plane 56 through the press nip 38 is inclined relative to the vertical 58. The corresponding angle of incline α may be in the range of approximately 10° to approximately 45°, for example.

The two press belts 48 and 50 are provided with one open press surface each, allowing a corresponding dewatering. In particular, these two press belts 48 and 50 may each be blind bored and/or grooved.

However, the two press belts 48 and 50 may each be formed by a water permeable wire web. In this case, the sealing belts 44 and 46 should be provided with an open press surface, i.e., be grooved or blind bored. This considerably increases the dewatering capacity and is particularly important in the case of low dry contents prior to the press and/or in the case of high surface weights.

Subsequent to the press nip 38, the two press belts 48 and 50 are each guided around the respective deflection roll 60 and 62, with one groove 64 and 66 each being provided in the region of the deflection rolls in order to collect the water thrown off the corresponding press belt 48 and 50. A scraper 68 and 70 may be allocated to each of the deflection rolls 60 and 62. The two deflection rolls 60 and 62 are each driven.

As is discernible from Figure 2, both the upper press belt 48 and the lower press belt 50 may each be guided around at least one additional driven deflection roll 72 and 74. This deflection roll 72 and 74 preferably assumes the function of a belt travel control roll .

Additionally these two press belts 48 and 50 are each guided prior to the press nip 38 around a deflection roll 99 and 100. In general, these deflection rolls 99 and 100 may also assume the function of a belt travel control roll.

The press surface of the two press belts 48 and 50 may be provided with the same hardness. As mentioned above, in the present case, they are open in order to provide a corresponding dewatering. Here, they may be blind bored and/or grooved, for example.

However, the two sealing belts and/or roll jackets 44 and 46 of the two shoe press units 34 and 36 are preferably provided with a continuous, smooth surface.

In particular, felts with few markings, causing a symmetrical dewatering, may be used for the upper felt 52 and the lower felt 54.

As is particularly discernible from Figure 2, the press belts 48 and 50 are guided separately from the sealing belts 44 and 46 outside of the press nip 38.

As shown in Figure 3, particularly using the lower press shoe 40 as an example, both a pressing 76 is possible by means of a row of pistons as well as a pressing 78 by means of two rows of pistons.

As implied for the upper press shoe 40 at the position 80, for example, an oil feeding via pistons or via a shoe is possible in order to lubricate the regions between the shoe 40 and the sealing belt 44.

In the upper part of Figure 3, the pressure progression P resulting in the web travel direction L over the elongated flat or level press nip 38 is implied.

As is discernible from Figure 2, the fibrous material web 30 may be accepted

by a wire belt 82 through the upper felt 52 in the present exemplary embodiment. In the transfer region 84, the upper felt 52 is guided around a suctioned guidance roll 84.

The two felts 52 and 54 are guided together even before the press nip 38 in the region of a deflection roll 86, arranged inside of the loop of the lower felt 54, and, subsequently, are guided together with the fibrous material web 30 positioned therebetween to the press nip 38 extending over the distance l. Subsequently, the fibrous material web 30 is guided together with the two felts 52 and 54 out of the press nip 38. Here, as is discernible from Figures 2 and 3, the sandwich to be pressed comprising the two felts 52 and 54 and the fibrous material web 30 positioned therebetween is guided straight through the press, where a straight guidance may be provided, in particular a certain distance prior to the press nip 38 and a certain distance after this press nip.

After the press nip 38 and subsequent to the section of straight guidance of the subsequent sandwich, the fibrous material web 30 is guided together with the lower felt 54 around a suctioned, preferably driven, guidance roll 88, in the region of which the web is accepted by a drying wire 90, for example, in order to guide it to the initial drying cylinder 92 of the drying section.

In the present case, the fibrous material web 30 is accepted by the drying wire 90 in the region between the suctioned guidance roll 88 and another guidance roll 94 allocated to another lower felt 54.

In the region of the transfer position 96, the drying wire 90 is guided around a suctioned guidance roll 98.

In the present case, as is discernible from the two Figures 2 and 3, the two press belts 48, 50 are separated from the two felts 52 and 54 and the fibrous material web 30 positioned therebetween immediately following to the press nip 38.

It is noted that the foregoing examples have been provided merely for the

purpose of explanation and are in no way to be construed as limiting of the present invention. While the present invention has been described with reference to an exemplary embodiment, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitation. Changes may be made, within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the present invention in its aspects. Although the present invention has been described herein with reference to particular means, materials and embodiments, the present invention is not intended to be limited to the particulars disclosed herein; rather, the present invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims.

LIST OF REFERENCE CHARACTERS

10	concave press shoe
12	shoe press roll
14	mating roll
16	flexible press jacket
18	press nip
20	upper felt
22	lower felt
24	neutral fibers
26	elastic sandwich
28	press section
30	fibrous material web
32	shoe press
34	shoe press unit, shoe press roll
36	shoe press unit, shoe press roll
38	elongated press nip
40	press shoe
42	press shoe
44	sealing belt, roll jacket
46	sealing belt, roll jacket
48	press belt
50	press belt
52	upper felt
54	lower felt
56	press plane
58	vertical

60	deflection roll
62	deflection roll
64	groove
66	groove
68	scraper
70	scraper
72	deflection roll
74	deflection roll
76	pressing with one row of pistons
78	pressing with two rows of pistons
80	position
82	wire belt
84	suctioned guidance roll
86	deflection roll
88	suctioned guidance roll
90	drying wire
92	drying cylinder
94	guidance roll
96	transfer position
98	suctioned guidance roll
99	deflection roll
100	deflection roll

L	web travel direction
l	press nip length
α	angle of incline